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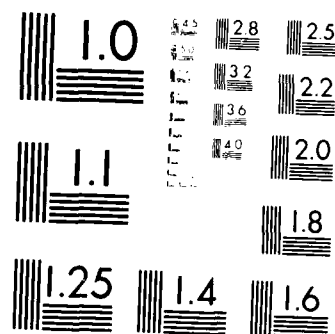
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FINAL REPORT FOR CONTRACT N00014-86-D-0701
BROADBAND CORRELATION ANALYSIS

Report SAIC-87/1873



Science Applications International Corporation

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BROADBAND CORRELATION ANALYSIS

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13 November 1987

Final Report

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FINAL REPORT FOR CONTRACT N00014-86-D-0701
BROADBAND CORRELATION ANALYSIS

1. INTRODUCTION

1.1 Contract Information. This document is the final report for Office of Naval Research Contract Number N00014-86-D-0701. The work under this contract was conducted by Science Applications International Corporation (SAIC) during the period from 28 April 1987 through 13 November 1987.

1.2 Reports. The bulk of the work under this contract has been reported to PMW180-42 during the Broadband Workshop meetings. These results have been documented in SAIC report No. MDCCD 87:3107.

2. BROADBAND ANALYSES

2.1 Statement of Work. "SAIC will provide an assessment of the detection, localization and classification performance of broadband correlation processing. In particular the efficiency and degradations associated with candidate correlation algorithms shall be examined. Analysis shall seek to identify optimum processing parameters for specific acoustic environments, measure the achievable recognition differential using Testbed data, and evaluate the utility of multipath detection. In addition the task shall address the potential for additional detection sensitivity by combining spatial and processing gain through broadband beamforming techniques."

2.2 Correlation Performance. SAIC developed system performance models to evaluate different broadband correlation algorithms. These included the Smooth Coherence Transform (SCOT) algorithm, the PHase Transform (PHAT) algorithm and the Clipped Correlator. Algorithm performance was evaluated in terms of sensitivity to direct and surface path detection as well as robustness against CW tonal contamination.

2.3 Optimal Processing Parameters. SAIC processed operational and experimental data collected at the FDS

Testbed in order to determine optimal frequency bands for broadband detection. These data included a variety of platforms at several speeds. In addition an analytical model of Doppler degradation was implemented to determine the optimal integration times for different system configurations. Based on these analyses recommendations were made for processing parameters to be used in a Fixed Distributed System (FDS).

2.4 Recognition Differential. SAIC developed and implemented a dynamic target signal synthesizer to determine the achievable recognition differential (RD) for different system configurations. This code was supplied to the Naval Surface Weapons Center where it was exercised and its output processed for determination of the RD parameter.

2.5 Multipath Detection. SAIC processed operational and experimental data in different frequency bands to determine the detectability of the surface reflected path. Several possible mechanism for detection degradation were identified and analytical models of these effects were developed in order to quantify the relative impact as a function of processing parameters.

2.6 Broadband Beamforming. SAIC developed a computer code for conventional and adaptive beamforming of broadband signals. The code was run on synthesized data to determine the relative advantage of the adaptive processor when a weak target is in the presence of a strong interferer.

3. OTHER EFFORTS

3.1 Activities. During the contract period SAIC participated in several efforts in support of the FDS Broadband program:

3.1.1 Experiment Planning. SAIC actively participated in the planning of the broadband phase of the TBEX-5 experiment as well as the July broadband experiment. This involvement included the prediction of system performance and overall design to assure the collection of meaningful data.

3.1.2 Research and Workshop Coordination. X. Zabala organized several working sessions with researchers from ARL:UT, NSWC and ATT/BL to discuss broadband processing issues and determine best approaches for resolving some of the critical problems. As Chairman for the Broadband Group Mr. Zabala coordinated the research effort between these organizations.

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